MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 1, 2015/2016 SESSION

PTG 0016 – TRIGONOMETRY AND COORDINATE GEOMETRY

(All sections / Groups)

16 OCTOBER 2015
3.00 p.m – 5.00 p.m
(2 Hours)

INSTRUCTIONS TO STUDENTS

1. This question paper consists of 3 pages with 4 questions and an appendix.

2. Answer **all** questions. Each question carries equal marks and the distribution of marks is as stated.

3. Unless stated otherwise, if an answer is given as a decimal, it should be rounded to **four** significant figures.

4. Please write your answers in the Answer Booklet provided.

5. All necessary workings **must** be shown.

Question 1

(a) If $\sin\theta = \frac{2}{3}$ and θ is in the second quadrant, sketch θ and its reference angle in the xy-plane and find the exact value of the remaining trigonometric functions. [7 marks]

(b) Verify the identity $\sin^3\theta - \cos^3\theta = (\sin\theta - \cos\theta)(1 + \frac{1}{2}\sin 2\theta)$. [6 marks]

(c) Find all possible θ (in radian) that satisfy $\tan(\theta + \frac{\pi}{5}) = \sqrt{3}$ on the interval $0 \le \theta < 2\pi$. [5 marks]

(d) (i) Find p in Figure 1 below. [5 marks]

(ii) Find the area of the triangle ABC in Figure 1 below. [2 marks]

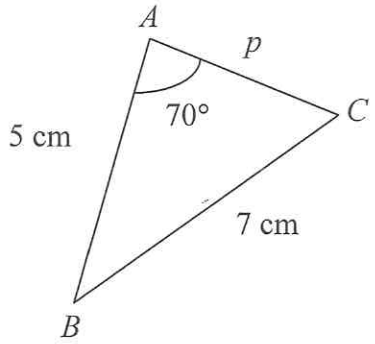

Figure 1

Question 2

(a) Evaluate the following in standard form if $p = -4 + 3i$ and $q = 2 + i$.

(i) pq [2 marks]

(ii) $\frac{q}{p}$ [4 marks]

(iii) $2p - q$ [2 marks]

(b) Evaluate i^{-11} in standard form. [3 marks]

(c) (i) Convert rectangular coordinates (–6, –3) to polar coordinates. Express the angle in radian. [3 marks]

(ii) Convert polar coordinates $(-6, -\frac{\pi}{3})$ to rectangular coordinates. [3 marks]

(d) Show that $r = 2\cos^2\theta$ in rectangular form is $(x^2 + y^2)^3 = 4x^4$. [3 marks]

(e) If $m = \sqrt{3}(\cos\frac{\pi}{5} + i\sin\frac{\pi}{5})$ and $n = \sqrt{5}(\cos\frac{\pi}{4} + i\sin\frac{\pi}{4})$, find mn and $\frac{n}{m}$ in rectangular form. Round the answers to three decimal places. [5 marks]

Continued...

Question 3

(a) Line l_1 passes through the x-axis at 5 and the point (2, –11).

(i) Find the slope and y-intercept of line l_1. [4 marks]

(ii) Find the distance from the point (10, 0) to the point on line l_1 whose x-coordinate is –10. [3 marks]

(iii) Find the line that is parallel to line l_1 and passes through the point (–5, –4) in slope-intercept form. [2 marks]

(b) The equation of a circle is $x^2 + y^2 + 2x - 10y + 10 = 0$.

(i) Find the radius of the circle. [3 marks]

(ii) Sketch the circle. Show its centre and four key points. [6 marks]

(iii) Find the y-intercepts of the circle. [3 marks]

(c) An ellipse has the equation $4x^2 + y^2 + 16x - 8y + 16 = 0$. What is the length of its minor axis? [4 marks]

Question 4

(a) If $A = \begin{bmatrix} -5 & -4 \\ -11 & 25 \end{bmatrix}$, $B = \begin{bmatrix} 2 & -1 \\ 5 & 0 \end{bmatrix}$ and $C = \begin{bmatrix} 3 & 4 & 1 \\ 4 & -3 & 1 \end{bmatrix}$, find

(i) $2A+B$, [2 marks]

(ii) $2B-A$, [2 marks]

(iii) AC, and [2 marks]

(iv) CB. [1 mark]

(b) Find z in the following linear system using Cramer's rule.

$$2x - y + 3z = 1$$
$$3x - 2y + z = 2$$
$$x - y - z = -3$$

[6 marks]

(c) Convert the following linear system into a matrix equation. Hence, solve it using inverse of matrix.

$$x + 2y = 5$$
$$-3x + 5y = 1$$

[4 marks]

(d) Find the inverse of $A = \begin{bmatrix} -2 & 0 & 3 \\ 5 & 1 & -4 \\ 2 & -2 & 2 \end{bmatrix}$. [8 marks]

Continued...

APPENDIX

$$\sin^2\theta+\cos^2\theta=1$$
$$\tan^2\theta+1=\sec^2\theta$$
$$1+\cot^2\theta=\csc^2\theta$$

$$\cos(A+B)=\cos A\cos B-\sin A\sin B$$
$$\cos(A-B)=\cos A\cos B+\sin A\sin B$$
$$\sin(A+B)=\sin A\cos B+\cos A\sin B$$
$$\sin(A-B)=\sin A\cos B-\cos A\sin B$$
$$\tan(A+B)=\frac{\tan A+\tan B}{1-\tan A\tan B}$$
$$\tan(A-B)=\frac{\tan A-\tan B}{1+\tan A\tan B}$$

$$\sin 2A=2\sin A\cos A$$
$$\cos 2A=\cos^2 A-\sin^2 A$$
$$=2\cos^2 A-1$$
$$=1-2\sin^2 A$$
$$\tan 2A=\frac{2\tan A}{1-\tan^2 A}$$

$$\sin^2 A=\frac{1-\cos 2A}{2}$$
$$\cos^2 A=\frac{1+\cos 2A}{2}$$
$$\tan^2 A=\frac{1-\cos 2A}{1+\cos 2A}$$
$$\tan A=\frac{\sin 2A}{1+\cos 2A}$$
$$=\frac{1-\cos 2A}{\sin 2A}$$

$$\sin A\cos B=\frac{1}{2}\left[\sin(A-B)+\sin(A+B)\right]$$
$$\cos A\cos B=\frac{1}{2}\left[\cos(A-B)+\cos(A+B)\right]$$
$$\sin A\sin B=\frac{1}{2}\left[\cos(A-B)-\cos(A+B)\right]$$

$$\sin A+\sin B=2\sin\frac{A+B}{2}\cos\frac{A-B}{2}$$
$$\sin A-\sin B=2\cos\frac{A+B}{2}\sin\frac{A-B}{2}$$
$$\cos A+\cos B=2\cos\frac{A+B}{2}\cos\frac{A-B}{2}$$
$$\cos A-\cos B=-2\sin\frac{A+B}{2}\sin\frac{A-B}{2}$$

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